EMULATING MOTHER NATURE

HOW BIOREMEDIATION OCCURS IN MOTHER NATURE

We need to first explain what happens In Mother Nature when a hazardous material is spilled. (Note that the key words used here are set in bold and defined in a simple glossary on the last page.)

There is a myriad of **bacteria** everywhere on the planet. Where a toxic spill comes in direct contact with bacteria, that bacteria is killed or dies off. Bacteria that is proximal [near] to the spill but not in direct contact, reacts in several ways:

- First, the bacteria separate themselves far enough away so as to protect themselves from the toxicity of the spill.
- Second, the bacteria then releases **enzymes** and **biosurfactants** to attack the spill.
- Third, the biosurfactants **emulsify** and **solubilize** the spill.

What this means is the biosurfactants will break up and partition the spill into a manageable consistency. In other words, it is breaking down the molecular structure of the spill or detoxifying it, so it can be used as a food source.

The enzymes then form binding sites on the emulsified or solubilize spill and this is where the bacteria will initially attach themselves and start the digestive process.

There have to be large amounts of bacteria for this process to take effect, and, if left solely to nature, it is a long process for bacteria to acclimate themselves to a spill. It then takes further time for the bacteria to release enzymes and surfactants.

One of the limiting factors is the number of bacteria present to produce and release enough enzymes and surfactants to get the process started.

This is why you hear scientists talk about adding nutrients to jumpstart the rapid growth of bacteria so enough enzymes and biosurfactants can be released to affect the mitigation of the spill.

However, nutrients alone have limited uses because of concentration requirements which are compromised in various environments--washed away or diluted by wave motion—and that, compounded with the time it takes to grow a large population of bacteria, reduces their effectiveness.

Wouldn't it be nice if there were a means of emulating Mother Nature while at the same time, speeding up the process to mitigate in hours, days or weeks what Mother Nature takes months and/or years to handle on her own?

There is such a solution: OIL SPILL EATER II

OIL SPILL EATER II (OSE II) contains exact proportions of enzymes, bio surfactants, nutrients and other necessary constituents for complete life cycles and biodegradation.

When OSE II is added to a spill, it is not necessary to wait on the proximal bacteria to release enough enzymes or bio surfactants since they are already supplied by OSE II. Therefore, the minute you apply OSE II, there is sufficient biosurfactants to start the emulsification and solubilization process. This process generally takes just a minute or two, or possibly several more minutes depending on the consistency of the spill. As the bio surfactants do their job, the enzymes are attaching themselves to broken down hydrocarbon structures, forming digestive binding sites.

Note: Once this process has occurred, several important changes take effect:

1. The fire hazard has diminished.
2. The toxicity of the spill is rapidly diminished.
3. The odor or smell is almost non-existent.
4. The oil or spill will no longer adhere to anything.
5. The spill is caused to float, OSE II will prevent the oil from sinking.

If the spill has not reached a shoreline yet, but does so after application, it will not adhere to wildlife, sand, rock, wood, metal, or any vegetation.

If the spill has already attached itself, once application occurs, the spill will be lifted from sand, rock, wood, metal or vegetation and wildlife. OSE II is the perfect solution for cleaning up oiled wildlife and marine life because it works so swiftly and is non-toxic, causing the oil to just easily slough off once sprayed on. This causes less trauma for the animal being cleaned and a much faster and easier cleanup process.

The spill is detoxified to the point that indigenous bacteria (natural to a given environmental location) can now utilize the oil as a food source. This also diminishes toxicity to marine organisms, birds or wildlife.

OSE II causes the oil to float on the surface of the water, which reduces the impact to the sub-surface preventing secondary contamination of the water column or tertiary contamination on the floor of the body of water associated with the spill area. The spill being held on the surface will make it easy to monitor.

OSE II also has an extremely efficient nutrient system which is activated once you mix the product with natural water--water native to the spill environment.

While the spill is being broken down and detoxified, the indigenous bacteria already living in the natural water used to mix OSE II starts rapidly colonizing or proliferating the growth of large numbers of indigenous bacteria.

Once the bacteria run out of the OSE II's readily available nutrients, they convert over to the only food source left: the detoxified oil spill. The spill is then digested to CO2 and water. In some cases you can see bacteria growing on the spill; however, in a short period of time, the oil will be digested to CO2 and water before your eyes on a contained spill. In laboratory tests, once you see the water in the test beaker or aquarium become **turbid**, you know it is only a matter of time before the contaminant is remediated to CO2 and water.

Unlike mechanical cleanup, which cleans up a maximum of 20% of the oil spilled, OSE II will actually address 100% of a spill. This information is substantiated by the EPA's listing of OSE II on the National Contingency Plan for oil spills referred to as the NCP list, which contains the efficacy test performed for the EPA at LSU University. This documentation can be examined at: http://www.epa.gov/emergencies/content/ncp/products/oseater.htm.

Glossary of Key Terms:

Bacteria: are one-celled organisms with a simple cell structure. Some are helpful, some are harmful. Bacteria are probably the most numerous of all organisms. They can be found almost everywhere. Bacteria are important to the cycling of chemicals in nature. Without the good bacteria, the soil and water would soon become poor in nitrogen and all plants and animals would die.

Biosurfactants: are surface-active substances synthesized by living cells; they are generally non-toxic and biodegradable. Biosurfactants enhance the emulsification of hydrocarbons, have the potential to solubilize hydrocarbon contaminants and increase their availability for microbial degradation. The use of chemicals for the treatment of a hydrocarbon polluted site may contaminate the environment with their by-products, whereas support of the natural process of enzymes and biosurfactants will efficiently destroy pollutants, while being biodegradable themselves. (See: Wiki details http://en.wikipedia.org/wiki/Biosurfactant#Biosurfactants)

Emulsify: An emulsion is a mixture of two or more liquids which are normally immiscible (un-blendable). Hence surfactants emulsify and solubilize (make a substance soluble [able to be dissolved] or more soluble) e.g. oil and water are blended.

Enzymes: the chemical substances produced in the living cells of all plants and animals that act as catalysts in the regulation of biological processes. Some enzymes break down complex substances into simpler ones. All enzymes are proteins with a prosthetic group attached. The prosthetic group of an enzyme is the part of the molecule that catalyzes (causes or speeds) the chemical change.

Soluble: designed to be dissolved in water. Solubilize means to make something dissolve in water.

Turbid: not clear or transparent because of stirred-up sediment or the like; clouded; opaque.